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Procedia Technology 24 (2016) 1055 – 1060

Procedia Technology

International Conference on Emerging Trends in Engineering, Science and Technology (ICETEST - 2015)

# Novel method of detecting moving object in video

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**Abstract**

In the modern trends, intelligent video surveillance system is a very important and relevant topic of research. It is well suited for a broad range of applications which includes, video communication, security and surveillance,public areas such as airports,traffic control,monitoring activities at traffic intersections for detecting congestions, and then predicting the traffic flow which assists in regulating traffic, underground stations, mass events, etc. The main disadvantage of the system is,the storage space required for storing these data and retrieval of the same on demand. For these human resources are needed but manually reviewing the large amount of data often impractical. The proposed work focused on bringing effective and efficient system with intelligence to avoid human intervention in identifying security threats. In this paper, the moving objects in a video detected by using a method of optic flow with morphological operation.


Peer-review under responsibility of the organizing committee of ICETEST – 2015

*Keywords:* Moving Object Detection; morphological operation; optical flow

## 1. Introduction

Security has become a mounting problem in the modern world where detection of crimes and hideous movements is mainly based on hidden cameras and closed circuit TVs. The images reflected on these devices have helped finding out the convicts of many a crime. Surveillance is also of prime importance in all organizations to protect the interests of the organization and their activities. The methods of detecting moving objects have thus become a prime concern in the modern management. There are several methods which are currently used for the purpose, all of which have some shortcomings or other. The objective of this paper is to study and analyze a novel method of detecting moving objects which is almost foot proof method. The study includes an analysis of the prior methods or currently available method and compares with the new method to prove its efficiency and it can be visualized. The new task of identifying the physical movement of an object in an area is significant because the system is used in the complex problems like video object classification and tracking.

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Peer-review under responsibility of the organizing committee of ICETEST – 2015
doi:10.1016/j.protcy.2016.05.235

The identification of the actual shape of a moving object is relevant because the detection of the actual shape is challenged by many obstacles like dynamic scene changes, light variation, presence of shadow and so forth [1]. Actually the aim of detecting a moving object is to discover the foreground of the moving target either in every video sequences or in the first video frame. The detection is done through moving or fixed camera [6]. The main purpose of detection is to distinguish the foreground of the object from the stationary background [4]. In short the objective is to detect the objects that are in motion with respect to their background scene. In stationary camera the background is static.

The application of digital image processing is so varied .One of the simplest ways to develop a basic understanding of the extent of image processing application is to categorize images accordingly to their source[7]. In image processing image acquisition is the initial process. Image enhancement is among the simplest and most appealing areas of digital image processing[7]. The notion behind enhancement techniques is to bring out detail that is obscured, or simply to highlight certain features of interest in an image [7]. It is very subjective area of image processing.

Video surveillance is one of the currently challenging research topics in computer vision. Videos are sequences of images, individual images are called frame, displayed in fast enough frequency so that human eyes can percept the continuity of its content. All image processing techniques can be applied to each frames.

In this paper, the enhancement method used is morphological operation. Morphological processing deals with tools for extracting image components that are suitable for the representation and description of shape. The fundamental morphological operations are dilation (expands an image) and erosion (shrinks an image).

## 2. Current methods of detecting moving object

The current methods of detecting moving objects are background subtraction, frame differencing, temporal differencing and optic flow [4].

### *2.1. Background subtraction*

This method is most used method for moving object detection [1].As the name suggests, it is the process of separation of foreground objects from the background in a sequence of video frames. Fundamental logic is the difference between current frame and a reference frame. Reference frame is also called as background image. The selection of background (background modeling) can be classified into two categories which are recursive and non-recursive techniques [2].Recursive technique includes frame differencing, linear predictive filter, median filter, and nonparametric model. Non-recursive technique uses method of sliding window approach for background estimation. Non-recursive techniques are highly adaptive, they do not depend on history of frames stored in buffer. This method is not suited for the background is dynamic, illumination changes or in the presence of shadow [1].

### *2.2. Frame differencing*

This method identifies the presence of moving object by considering the difference between two consecutive frames[1].By subtracting second image from the first image frame using image subtraction operator in consecutive frame to get the desired output. It is an efficient method for detecting gray level changes between images by using frame differencing algorithm [3]. The algorithm may be subdivided into three parts. Initial step is the selection of perfect reference or background. Second step is the arithmetic subtraction operation and the third step is the selection of a suitable threshold. Reference image can be selected as a frame which is temporally adjacent image from a dynamic sequence. This method lacks in obtaining the complete contour of the object.

### *2.3. Temporal differencing*

In this method moving target can be detected by using pixel wise difference among two successive frame[4].Currently used temporal difference method is flexible to dynamic changes in the scene but slowly moving target cannot be detected[1].The disadvantage is that converging regions are detected as moving object, the output contains noise due to motion estimation error. Noise in the background pixel is falsely identified as motion pixel. The higher the error, the output will contain more noise.

Three temporal differencing is the technique in which continuously subtracting image pixels. In this case three consecutive image subtraction methods are used.

### *2.4. Optic flow*

It is based on calculation of optical flow field of image or video frame [1]. Clustering is performed on the basis of the obtained optical flow distribution information obtained from the image (video frame).This method allows in obtaining the complete knowledge about the movement of the object and is useful to determine moving target from the background [1].When an observer moves in a straight line through a stationary scene, the optic flow field forms a radial pattern [9]. The center of this pattern, where the image motion is zero is known as focus of expansion. A moving object in the scene may introduce image velocities that are not in match with this pattern, and this inconsistency can be used to detect the presence of a moving object. Discontinuities in optical flow can help in segmenting images into regions that corresponds to different object. The various applications of optical flow are object motion detection, action recognition, facial expression recognition, vehicle navigation etc. The disadvantage is large quantity of calculations are required to obtain optical flow information.

## 3. Novel approach

The problem of noise is one of obstructions in detecting an object in almost all cases. We may eliminate this by morphological operation to a certain extent. As in the case of background subtraction, the morphological filtering method removes the noise which will result in clear and sharp image[8]. Frame differencing, the other method used to detect moving object is easy to apply and faster than background subtraction in which the corresponding background images are not constant over time and again. The problem of motion estimation is due to the presence of shadows which are generated as a result of brightness and variation of illumination. The shadows are either along with the detected object or may be disconnected from it. In the first case, the shadows distorts the shape of the object,and in the second case the shadow may be totally misunderstood to be another object in the scene. The accuracy of the resultant moving object depends on the speed of the object and frame rate. Hence for fast moving object ,good results cannot be achieved. In such cases morphological operations are not suitable. But in temporal difference, where output contain noise, the morphological operation is applied to remove small and separated noises from actual motion.

In this paper used method is optical flow for moving object detection. In case of optical flow field,which is the velocity field that represents the 3D motion object points across a 2D image. Optical flow calculation is based on two assumptions. The first assumption is that the brightness of the observed object should be constant over the period of observation. This is the most applicable one. The second assumption, the adjacent points in the image frame should move in a similar manner. This is known as velocity smoothness constraint. This is deal with detection accuracy and stability estimation. To isolate moving object from the background, the average displacement should be computed and the flow should be used within the moving window which travels with an average motion. Some preprocessing operations are done to make the scene perfect.

Due to the higher accuracy of the optical flow, it is more appropriate method for multiple moving object analysis. Besides the phenomenon of occlusion and overlapping of objects may be avoided to a large extent [10]. The changes of moving object location between the frames can be observed by using the optical flow. The optical flow describes the direction of two consecutive frames. So by using optical flow the direction of moving object also can be analyzed.

For morphological operation, A and B are in the set of $Z^2$ .Where A is the input image and B is th structuring element. The dilation of A by B ,A $\oplus$B is defined as

$$A \oplus B = \{z|(\hat{B})_z \cap A \neq \phi\} \tag{1}$$

The equation is based on obtaining the reflection of B about its origin and shifting this reflection by z. The dilation of A by B then is the set of all displacements, z, such that B and A overlap by at least one element[7].

$$A \oplus B = \{z|\left[(\hat{B})_z \cap A\right] \subseteq A\} \tag{2}$$

The erosion of A by B ,A ⊖B is defined as

$$A \ominus B = \{z | (B)_z \subseteq A\} \quad (3)$$

i.e. erosion of A by B is the set of all points in z, such that B translated by z is contained in A [7].The morphological methods mostly used are of two types,opened image processing and closed image processing. Opening smooth-es the contour of an object and eliminates thin portions. Closing also tends to smooth sections of contour but, opposed to opening, it generally fuses narrow breaks[7]. The opening of set A by B,

$$A \circ B = (A \ominus B) \oplus B \quad (4)$$

ie erosion of A by B, followed by a dilation of result by B. Similarly, closing of A by B,

$$A \bullet B = (A \oplus B) \ominus B \quad (5)$$

Closing of A by B is the dilation of A by B followed by the erosion of the result by B[7]. The result of open image processing is not well suited for our application. So moving object detection is the closed image process. In this paper closed morphological operation is used. Closed morphological operation is defined as dilation followed by erosion. So first remove nearby pixel values which are like noises then add some pixel values which result the shape of an detected object similar to the original object. After morphological closing process, the appearance of the object is not destroyed, the objects including many small holes and separated pixels are connected into one big actual shape, which will result in a clear and perfect detection of the moving object without any noise or disturbance.

## 4. Experimental Result

In this Fig 1(a) shows the first frame in the input video,Fig 1(b) is the seventy first frame in which we can see the clear moving objects and the Fig 1(c) is the seventy second frame used for the subtraction of two adjacent frames.Fig 2(a) shows the result of background subtraction method which is the earliest method for moving object detection and Fig 2(b) shows the morphological closed operation applied to the background subtracted image.Fig 3(a) shows the frame differenced image and Fig 3(b) is the closed image after frame difference.Fig 4(a) shows temporal differenced image and Fig 4(b) is the closed image after temporal difference.

Fig 5(a) is the proposed method output thats is the result of optical flow and Fig 5(b) is the closed image after the application of optical flow. So it is clear that proposed methods has over performed the existing methods.

Fig. 1. (a) first frame; (b) frame number 72;(c)frame number 71.

Fig. 2. (a) Background subtracted image; (b) Closed image of background subtraction.

Fig. 3. (a) Frame differenced image; (b) Closed image after frame differencing.

Fig. 4. (a) Temporal differenced image; (b) Closed image after temporal differencing.

Fig. 5. (a) Optical flow based image; (b) Closed image after optical flow.

## 5. Conclusion

In this paper moving object is detected by using optical flow, along with morphological operation (closed image processing).Morphological closing is applied to get a clear picture of the moving target. This paper is focused on the video which are captured by using static camera. In future this can be extended to moving camera and can be detect multiple objects.

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